PURCELL EFFECT OF QUANTUM NANOEMITTERS IN AN AIR-CORNER SET-UP

LABORATORY : Institut Lumière Matière

LEVEL : M2
TEAM(S) : AGNANO

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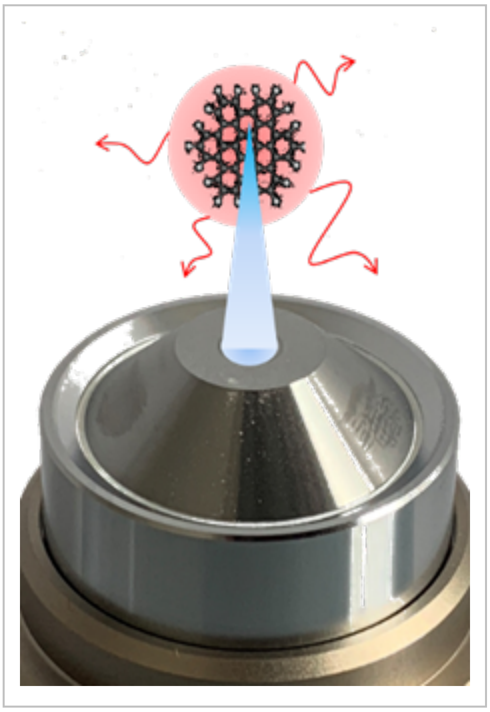
KEYWORD(S) : Fluorescence Microscopy / quantum dots / Quantum optics

SCIENTIFIC CONTEXT :

The ability to precisely localize the light at the nanoscale represents a major challenge with many potential applications in energy storage, for highly-sensitive sensors, for optical communications with slow light and for quantum optics.

In this context, our team at ILM studies optical nanostructures for light manipulation and propagation at the scale of single nano-objects such as single emitters (molecules or quantum dots), single plasmonic nanoantennas or plasmonic crystals. In particular, if a fluorescent nanoemitter is inserted in a nanocavity (sub-10nm thickness), its emission can be increased and specifically directed. On one hand, the emitter can be used to get information about the cavity. On the other hand, we can use the cavity to increase interactions between a few controlled emitters to achieve collective effects. The goal of the internship is to study the optical properties of quantum nanoemitters such as graphene quantum dots or dye molecules in collaboration with chemical labs in Vietnam and in ENS-Lyon. In particular, we are interested in the spectral and temporal properties of the luminescence emission.



MISSIONS :

The goal will be to control the decay rate of single photon emission in a variable nanocavity. Recently, we built a cavity in an air-corner configuration (similar to a Michelson interferometer configuration) with a very small angle made by 2 glass substrates. The local density of optical modes is modified around the emitter inserted inside the air-corner thus changing the lifetime of the emitter. Recently, we monitored this modification (see figure) with the cavity size e(µm) with a layer of quantum dots.The goal of the internship is to go further by controlling the angle of the device to finely tune the local density of modes around single quantum dots thus controlling their quantum emission rate through the Purcell effect.

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OUTLOOKS :

This subject may be continued as PhD thesis through the Doctoral school grant

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